

Application No. 09/391,943
Response to Office Action

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R E M A R K S

Reconsideration of this application, as amended, is respectfully requested.

RE: THE NEW CLAIMS

New claim 70 has been prepared based on the features of the present invention shown, for example, in Fig. 3, and the corresponding description in the specification. See, for example, the three-dimensional form recognizing unit 20, specular reflecting component separating unit 19, image interpolating and composing unit 18, observing light position changing unit 15, photographing environment information unit 5 and observing environment information unit 6.

New claims 71 and 72 have been prepared based on the disclosure in the specification at, for example, page 15, line 1 to page 16, line 4. See also, for example, Fig. 4.

New claims 73-75 have been prepared based on the features of the present invention shown in, for example, Figs. 6A, 6C, 7A and 8A, and the corresponding description in the specification. In particular, see Fig. 6C with respect to new claim 75, and see (now canceled) claim 56 with respect to new claim 74.

New claims 76 and 77 have been prepared based on, for example, Fig. 3 (the observation light form changing unit 16),

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and the disclosure in the specification at, for example, page 12, lines 12 to 15.

New claim 78 has been prepared based on the disclosure in the specification at, for example, page 17, lines 3-14.

New claim 79 has been prepared based on, for example, (now canceled) claims 45 and 46.

New claim 80 has been prepared based on, for example, (now canceled) claim 47.

New claim 81 has been prepared based on, for example, (now canceled) 58.

New claim 82 has been prepared to recite the "three-dimensional form recognizing unit," the "specular reflecting component separating unit" and the "interpolating and composing unit" recited in new claim 70, and the "observation light form changing unit" recited in new claims 76 and 77.

New claims 83-87 and 90-93 depending from new claim 82 correspond respectively to new claims 71-75 and 78-81 depending from claim 70.

New claims 88 and 89 recite the "observation light position changing unit" recited in new claim 70.

And new independent method claim 94 has been prepared based on the subject matter of both new independent claims 70 and 82.

No new matter has been added, and it is respectfully requested that new claims 70-94 be approved and entered.

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RE: THE CLAIM FEE

The application has previously contained as many as 27 claims in total, and as many as 4 independent claims, and the appropriate fees were paid for such claims. The application now contains 25 claims, of which 3 are independent. Accordingly, no claim fee is due. Nevertheless, authorization is hereby given to charge any additional fees which may be determined to be required to Account No. 06-1378.

RE: USP 6,697,062

USP 6,697,062 ("Cabral et al") was applied against (now canceled) claims 54 and 55.

However, Cabral et al has a filing date of August 6, 1999, which is after the September 8, 1998, filing date of JP 10-254034 whose priority is claimed by the present application.

Submitted herewith is an accurate English translation of JP 10-254034 to show that the claimed present invention is fully supported by the disclosure of JP 10-254034, and that the claimed present invention is therefore entitled to the claimed priority date of September 8, 1998.

It is respectfully submitted, therefore, that Cabral et al is not proper a reference against the claimed present invention, and it is respectfully requested that Cabral et al be withdrawn as a reference against the claimed present invention.

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RE: THE OTHER PRIOR ART REFERENCES

Claims 40-50, 58, 59 and 63-69 were rejected under 35 USC 103 as being obvious in view of the combination of JP 09-172649 ("Ooyama et al") and USP 3,922,093 ("Dandliker et al"); and claims 51-57 and 60-62 were rejected under 35 USC 103 as being obvious in view of the combination of Ooyama et al and Dandliker et al with one or more of USP 6,014,472 ("Minami et al"), USP 6,256,035 ("Katayama et al"), USP 6,697,062 ("Cabral et al"), USP 3,564,988 ("Jones"), USP 6,215,461 ("Ishibashi et al") and USP 4,757,379 ("Wright"). These rejections are, however, are respectfully traversed with respect to new claims 70-94 set forth hereinabove.

According to the present invention as recited in new independent claims 70 and 82, an image processing apparatus is provided for processing an image of an object. The apparatus comprises: a three-dimensional form recognizing unit which recognizes a three-dimensional form of the object by using image data of the object taken by an image input apparatus, and which outputs object three-dimensional form information regarding the three-dimensional form of the object; a specular reflecting component separating unit which separates a specular reflecting component from light reflected from the object in the image of the object, and which then outputs the specular reflecting component; and an interpolating and composing unit which subjects

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the image data of the object taken by the image input apparatus to interpolation and composition processing to thereby obtain an image of the object, and which then outputs the obtained image of the object.

According to the present invention as recited in new independent claim 70, moreover, the image processing apparatus comprises an observing light position changing unit which converts the image data of the object taken by the image input apparatus into an acquired image in which a direction of illuminating light for illuminating the object is changed, by using the three-dimensional form information, the specular reflecting component and the image obtained by the interpolation and composition processing, based on a difference between (i) photographing environment information comprising geometric information on a light source for illuminating the object when the object is photographed and (ii) observing environment information comprising information regarding an illumination environment of a place for observing an observation image of the object that is output from an image output apparatus, and which then outputs the acquired image.

And according to the present invention as recited in new independent claim 82, the image processing apparatus comprises, instead of the observing light position changing unit, an observing light form changing unit which converts the image data

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of the object taken by the image input apparatus into an acquired image in which a form of illuminating light for illuminating the object changed, by using the three-dimensional form information, the specular reflecting component and the image obtained by the interpolation and composition processing, based on the difference between the photographing environment information and the observing environment information.

New independent method claim 94, moreover, corresponds to both new independent apparatus claims 70 and 82.

With the structure of the claimed present invention, the texture and glossiness, for example, of the object can be reproduced, even if the image of the object is observed in an illumination environment that is different from the illumination environment at the time of photographing the object. In particular, the texture and glossiness, for example, can be reproduced even if the image of the object is observed with illumination applied from a direction or in a different form from that with which the object was photographed.

By contrast, it is respectfully submitted that Ooyama et al (as recognized by the Examiner) merely discloses using information regarding illuminating light where the object is photographed and information regarding illuminating light where the taken image of the object is reproduced to reproduce the image of the object with color reproduction.

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In addition, it is respectfully submitted that (as recognized by the Examiner) Dandliker et al merely discloses measuring the roughness of the surface of an object, and that information regarding reflection of light from the object includes spectral reflection information. That is, it is respectfully submitted that Dandliker et al merely discloses that the information regarding the roughness of the object is acquired from the spectral reflection information from the object by using a plurality of images of the object.

Still further, it is respectfully submitted that Minami et al merely discloses an apparatus in which a light source (whose form is selected) for virtual illumination of an object in an observation image can be located in an arbitrary position.

Yet still further, it is respectfully submitted that Katayama et al merely discloses converting acquired images based on information regarding the position of the object at the time of photographing the object.

And it is respectfully submitted, moreover, that Jones has merely been cited for the disclosure of positioning objects on a turntable to photograph them from a plurality of directions, that Ishibashi et al has merely been cited for the disclosure of a head-mounted display for displaying a three-dimensional image, and that Wright has merely been cited for the disclosure of a movable illumination source.

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In view of the foregoing, it is respectfully submitted that the cited references, taken singly or in combination, do not disclose, teach or suggest either: (A) an observing light position changing unit which converts the image data of the object taken by the image input apparatus into an acquired image in which a direction of illuminating light for illuminating the object is changed, or (B) an observing light form changing unit which converts the image data of the object taken by the image input apparatus into an acquired image in which a form of illuminating light for illuminating the object changed, by using the three-dimensional form information, the specular reflecting component and the image obtained by the interpolation and composition processing, based on a difference between (i) photographing environment information comprising geometric information on a light source for illuminating the object when the object is photographed and (ii) observing environment information comprising information regarding an illumination environment of a place for observing an observation image of the object that is output from an image output apparatus, and which then outputs the acquired image, in the manner of the claimed present invention as recited in each of new independent claim 70 (A), new independent claim 82 (B) and new independent claim 94 (A and B).

Accordingly, it is respectfully submitted that the claimed present invention as recited in new claims 70-94 patentably

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distinguishes over Ooyama et al, Dandliker et al, Minami et al, Katayama et al, Cabral et al, Jones, Ishibashi et al and Wright, taken singly or in any combination consistent with the respective fair teachings thereof, under 35 USC 103.

* * * * *

Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned for prompt action.

Respectfully submitted,

/Douglas Holtz/

Douglas Holtz
Reg. No. 33,902

Frishauf, Holtz, Goodman & Chick, P.C.
220 Fifth Avenue - 16th Floor
New York, NY 10001-7708
Tel. No. (212) 319-4900
DH:db/iv
encs.